Influence of both lateral domain formation and interface domain wall on exchange bias phenomena in TbFe/GdFe ferromagnetic bilayers

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First, exchange bias (EB) in a ferrimagnetic TbFe/GdFe bilayer showing antiferromagnetic interface coupling has been studied as a function of magnitude H_{cf} and angle $\_{cf}$ of the cooling field. By combining magnetisation, ac-susceptibilty and ultra sensitive magnetoresistance measurement with a micro-magnetic calculation, we are able to identify the interface magnetic profile. The magnetic configuration present at the GdFe/TbFe interface was also studied using Polarised Neutron Reflectometry (PNR). Continuous transition from negative to positive exchange bias has been observed either with increasing H_{cf} or with increasing $\_{cf}$. Those effects are explained by the quenching of the magnetic configuration inside the TbFe which lead to the presence of a frozen partial interface domain wall. Effect of the chirality of this domain wall on H_E has been clearly indentify. The EB field transition is find to arise from a continuous rotation of the direction of the interfacial pinning acting on the GdFe layer. Also, the effects of lateral magnetic domains on EB have been investigated. The occurrence of multi-domain state is found to give rise to exotic and tunable hysteresis loops at low temperature. The results are being fully understood by taking into account both the presence of lateral domains and interface domain wall.

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Keywords: Exchange Bias, Magnetic domain wall, Chirality transition